POWER MARKETING ADMINISTRATIONS' FIBER-OPTICS EXECUTIVE SUMMARY REPORT TO CONGRESS:

WESTERN AREA POWER ADMINISTRATION (WAPA), SOUTHWESTERN POWER ADMINISTRATION (SWPA), BONNEVILLE POWER ADMINISTRATION (BPA)

May 24, 2000

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Power Marketing Administrations' Executive Summary Report to Congress:

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✍ **Note:** Southeastern Power Administration has no fiber-optic installations or program; that PMA is therefore not included in this report.

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INTRODUCTION

On September 27, 1999, the House of Representatives issued the Conference Report on H.R. 2605, Energy and Water Development Appropriations Act, 2000. The conference report addressed fiber-optic cable installation by the power marketing administrations (PMAs), requesting that each prepare a "comprehensive fiber-optic cable plan" to include all activities relating to installation, operation, marketing, and leasing of fiber-optic cables and related communications operations.

Specifically, the plan was to include details on current and future operational needs, a summary of current leases, planned leasing costs and revenues, and the criteria used to determine: 1) when and where to install fiber-optic cable; and 2) leasing agreements. It would also contain summary tables with cost-per-mile figures, outyear projections, and expected revenues for comparisons among the PMAs; a justification for all fiber-optic cable installations; and the PMA-specific statutory authority for these activities.

This **Executive Summary Report** presents the fiber-optics plans and programs for three Power Marketing Administrations (PMAs) that fall under the province of the Department of Energy.

- **Part I** describes the similarities in the fiber-optic program approaches of the three PMA's.
- **Part II** describes the differences in their regions, populations, terrain, and service.
- **Part III** describes the differences in their fiber-optics plans.
- **Appendices:** More detailed individual reports from each PMA are attached as appendices to this document.

BACKGROUND

Western Area Power Administration (WAPA), Southwestern Power Administration (SWPA), and Bonneville Power Administration (BPA) need to ensure the reliability of their respective transmission systems with high-speed, flexible, reliable systems of communication. Fiber-optic installation increases PMA communication capacity and brings each agency up to date with contemporary technology. The North American

Electric Reliability Council and the Federal Energy Regulatory Commission recommend that critical telecommunications facilities be the responsibility of the electric utility and that they be under their complete control.[1]

BPA has traditionally held that only through BPA ownership of the cable itself could the needed level of reliability properly be served and the required schedule for upgrade of communications be met. However, in the future BPA will encourage third-party or joint ownership through limited competition for new fiber-optic projects, where such ownership meets BPA pole attachment criteria (currently under revision) and is the least-cost alternative. BPA is revising its fiber-optic pole attachment policy and developing criteria to ensure that the BPA reliability, safety, and maintenance needs and standards would be met for communications, infrastructure, and future transmission needs, to name a few. These criteria will include advising the third party that they may need to obtain and pay for any additional easements along the route where BPA does not own the underlying land in fee; to negotiate and pay for permits to cross lands, including Bureau of Land Management, Forest Service, and tribal lands; and to understand their responsibility for all taxes. The third party would also be required to obtain a BPA permit for crossing BPA fee-owned land.

Fiber-optic cable systems provide a state-of-the-art communication option to support the PMA's respective communication systems. Within the last 15 years, the PMAs have used fiber-optic cable both as an enhancement, and replacement for existing communication systems. Fiber-optic cable offers many benefits over older technologies. These benefits fall into three basic categories: improved communication capacity, improved reliability, and cost effectiveness.

The need for improved communication carrying capacity is becoming more important. Communication circuits carry data that support the following applications: supervisory control and data acquisition; transmission line protection; real-time wide-area measurement and control; control area telemetry; digital fault recording and sequence of events recording for power system trouble reporting, analysis, and remedy; timing and synchronization; security; revenue metering; maintenance augmentations of digital microwave systems; and voice communications. These applications are critical to safe and reliable transmission system operation.

Fiber-optic cable is more reliable than other communications mediums such as power line carrier, leased telephone lines, and analog microwave. The reliability of power line carrier has been called into question, and leased telephone lines are subject to telephone company problems including line outages, delays with switching, and overloaded lines during emergencies. Microwave systems are susceptible to bad weather, causing fades and disrupted communications, whereas fiber-optic cable communications are consistent and reliable. For shorter runs between microwave sites and substation control buildings, or between substation control buildings and

[1] Federal Power Commission (now Federal Energy Regulatory Commission) Advisory Committee Report on Reliability of Electric Bulk Power Supply, June 1967, Volume II, page 23; NERC Operating Manual, Policy 7, 1996, page 1-2. Also supported by findings of the National Security Telecommunications Advisory Committee, NSTAC, Telecommunications Systems Survivability Task Force Final Fl Report, February 1990.

power plant control/communication rooms, fiber-optic cable provides greater reliability than copper conductors do. This is because fiber provides electrical isolation between the two facilities and their communication equipment, whereas copper conductors can allow current to flow between the sites during fault conditions that could possibly damage communication equipment and endanger personnel. Fiber-optic cable is also ideal for short runs within electrical substations because it is immune to the electrical noise influence on communication circuits, which is caused by the substation environment.

Lastly, fiber-optic cable is cost-effective, having a service life of about 40 years. Although fiber-optic communication is initially more expensive than digital microwave communication systems, microwave equipment has a much shorter life span of about 15 years. Fiber-optic cable generally does not require new land rights, as perhaps a new microwave system would, being able to take advantage of existing transmission line rights-of-way. Because of all of the advantages of fiber, other entities (including the Federal hydro-generators, regional utilities, and telecommunications service providers) are often interested in fiber-optics in the same locations. In these instances, partnering agreements with these entities greatly reduce equipment, installation, and maintenance costs.

PART I: SIMILARITIES IN FIBER-OPTICS APPROACHES

The following similarities characterize the three PMAs in their fiber-optics programs.

- **Invest to meet operational needs**. WAPA, SWPA, and BPA place prime emphasis on building/upgrading backbone communications to meet operational needs, which require improved communication capacity, improved reliability, and cost-effectiveness.

  Direct, commonly expressed causes for replacement or upgrading of existing systems to meet operational need include the following:

  (1) aging, obsolete, and failing power line carrier and analog microwave communication systems;

  (2) increasing demand on the power transmission system under the restructured utility market that requires the delivery of more data, faster, to more requesting parties within and outside their respective PMA regions;

  (3) less effective support through microwave systems that are more susceptible to weather and that require installation at points within line-of-sight;

  (4) increased difficulties in obtaining land rights for new sites that might be required for additional microwave support;

  (5) loss of radio spectrum due to Federal Communications Commission auctions;

  (6) leased line cost, serviceability by others, and uptime availability;

  (7) communication site and power line carrier outages; and

(8) reliability requirements of 99.986% defined by the Western Systems Coordinating Council (WSCC), and subscribed to by WAPA, SWPA, and BPA.

Direct benefits of installing fiber-optics as the medium for communication include the following:

(1) More communication capacity; more reliable than other communications mediums.

(2) Meets increased demand for communication, including real-time monitoring and controls; high-speed digital control and protection systems; data operation; database matching between control centers; revenue metering; digital fault recording and sequence of events recording for power system trouble reporting, analysis, and remedy; and wide-area measurement systems to monitor power system equipment performance.

(3) Immune to electrical noise influence in substations; provides greater communications reliability between substations.

(4) Service life of about 40 years, making it cost-effective over time (vs. microwave equipment with an average life span of 15 years).

(5) Generally does not require new land rights (vs. new sites for microwave installation).

(6) Allows PMAs to reduce dependence on Federal radio frequencies (spectrum).

(7) Increases value of the PMA's investment by improving the transmission system infrastructure.

(8) Allows PMAs to meet future new communication capacity needs without the environmental impacts of new construction (poles/towers already in place).

✍✍ **Own and maintain the cable.** WAPA, SWPA, and BPA currently own the fiber-optic cable that carries the respective PMA's data. Each PMA maintains its own cable and equipment. Maintenance by the PMA is regarded as the only way to meet the reliability standards required of an agency that serves as the backbone for electricity transmission over a wide geographic region that includes millions of consumers.

✍ **Note:** On two **WAPA** projects, a participating utility owns *individual* fibers. On one project, WAPA jointly owns the cable with the Bureau of Reclamation (Reclamation), Department of the Interior.

✍✍ **Note: SWPA** has partnered with another utility to share fibers installed on their respective systems to establish a fiber-optic loop. Some SWPA traffic will be carried on fiber owned by another utility, but licensed for SWPA's exclusive use.

✍✍ **Note: BPA** will encourage an alternative option: having a third party own the cable on which BPA carries agency data. Such an arrangement would be made on a case-by-case basis and be subject to criteria (currently under

development) that would guarantee PMA maintenance of the cable and reliability that matches standards such as the WSCC standard cited above.

- **Financing in part through third-party arrangements.**[2] All three PMAs have sought cost-effective ways to upgrade their communication systems. In each case, third-party arrangements have provided an avenue to reduce cost. Third parties may provide upfront costs, provide an annual fee, provide a share of revenues from fibers they lease to others, provide dedicated fibers that the PMA may lease, and/or provide terminal equipment. In some cases, cost-effectiveness is achieved by "swapping" a share of existing fiber-optic access on one route with a share of fiber-optic access on another (e.g., with the U.S. Army Corps of Engineers [Corps]). The details of third-party arrangements differ from agency to agency.

- **Leasing.** All three PMAs have made temporarily excess dark fiber available for leasing. To whom they lease, and under what conditions, differ (see Parts II and III). None of the three PMAs provides communication capacity across lighted fiber (lighted fiber services) for commercial purposes.

- **Use of any revenues from partnering/leasing.** All three PMAs use revenues to repay their respective Treasury debt and to provide their customers with the lowest rates possible consistent with sound business principles. Because WAPA collects revenues to repay several different projects, WAPA applies any revenues toward the repayment of the government's investment in the project upon which the fiber-optic system has been installed.

- **Lighting fiber only for own use.** Each PMA lights only the fiber that it uses for its operational needs.

  - **Note: WAPA, SWPA, or BPA** may provide lighted fiber services to a traditional transmission customer for utility operations if that customer is currently leasing or sharing channels on that PMA's existing analog microwave system. (As the PMA decommissions the existing system, the PMA may have to switch the customer over to fiber-optics so that the customer's communication system is not lost.) The PMAs would also consider providing lighted fiber to another federal agency.

- **Right-of-way issues**. The three PMAs treat right-of-way issues similarly. Where fiber-optic cable is strung on existing towers, most existing land rights agreements are interpreted to allow communication needs as an integral part of meeting transmission operational purposes, including most that use antiquated terms for communication facilities. A few, newer agreements specify appurtenances to include "communications" facilities. This means that fiber-optic cable can be strung without the need to re-negotiate agreements or obtain new rights for the vast majority of PMA routes.

[2] Some topics appear under both Part I (similarities) and Part III (differences).

Where a third party makes use of temporarily excess dark fiber, closer attention must be paid to ascertaining rights. If a third party were to own the cable, that entity would be responsible for ensuring that land rights were adequate/new rights were obtained.

- **Fiber-optic cable considered as part of a new project.** The three PMAs consider inclusion of fiber-optics for any new or upgraded projects on a case-by-case basis.

- **Relationships with other government or public entities**. **WAPA** worked in conjunction with Reclamation and the Central Arizona Project for a long fiber-optic cable installation; it also jointly installed fiber-optic cable with electric power cooperatives. More than half of its 19 fiber-optics projects have been cooperative projects. **SWPA** takes as a prime consideration opportunities to improve service to and partner with the Corps (Little Rock District, Tulsa District). It has also successfully partnered with a rural electric cooperative utility customer. **BPA** has worked cooperatively with telecommunications service providers (TSPs) and non-profit organizations on eight of the nine projects completed to date and continues to consider opportunities to partner with Corps, Reclamation, and other government entities.

PART II: DIFFERENCES IN SERVICE AND NEED

While the three PMAs share a number of goals and actions, they are also distinctly different in their territories, service needs, population, and other respects. An understanding of these differences is basic to understanding the discussion in **Part III**: Differences in Fiber-optic Approaches.

- **Service, Organization, Territory**

  - **Note:** All three PMAs are required to give preference in the sale of electric power to public bodies and cooperatives, including rural electric cooperatives, municipal utilities, and public utility districts.

  - **WAPA:** Markets power from 55 power plants operated by Reclamation, the Corps, and the International Boundary and Water Commission, in addition to 547 MW from the coal-fired Navajo Generating Station. Its service area covers 1.3 million square miles and reaches nearly 9.5 million people. WAPA provides service to more than 600 power customers in 15 Western states (Arizona, California, Colorado, Iowa, Kansas, Minnesota, Montana, Nebraska, Nevada, New Mexico, North and South Dakota, Texas, Utah, and Wyoming). With its Corporate Services Office in Lakewood, Colorado, it operates and maintains the transmission system from four regional offices (in Montana, Arizona, Colorado, and California) which have separate Federal allocation and marketing processes. The transmission system consists of just under

17,000 miles of transmission lines, nearly 260 substations, 356 microwave and VHF radio sites. The transmission line system uses wood pole and steel tower transmission lines with voltages ranging from 34.5-kv to 500-kv.

- **SWPA:** Markets the hydroelectric power produced at 24 Corps multipurpose dams located in Arkansas, Missouri, Oklahoma, and Texas. Its service area covers nearly 577,000 square miles, and reaches almost 7 million people and businesses. In addition to the states named above, SWPA provides service to consumers in Kansas and Louisiana. The transmission system consists of 1,380 miles of high-voltage lines, 23 substations, and 46 microwave and VHF radio sites. The transmission system is almost entirely wood-pole, with a maximum voltage of 161-kV. Three field offices (Oklahoma, Missouri, and Arkansas) and an Operations Center (Missouri) maintain and operate the transmission system. SWPA headquarters are located in Tulsa, Oklahoma.
- **BPA:** Markets power (about 40% of that consumed in the Northwest) from 29 federal dams operated by the Corps and Reclamation on the Columbia and Snake river systems in the Pacific Northwest (PNW), as well as from one non-federal nuclear plant. Its service territory covers about 300,000 square miles, and reaches about 10 million people. There are about 15,000 miles of transmission lines (about three-fourths of the region's high voltage capacity), 324 substations, and 440 microwave and VHF radio sites. The transmission system uses steel towers and wood poles; voltage runs from 115-kV to 500-kV. BPA provides service to consumers in four primary states (Washington, Idaho, Oregon, and Montana west of the Continental Divide) and to small parts of California, Utah, Nevada, and Wyoming. It maintains power transmission links to Canada and California via the Intertie; it sells surplus power (after PNW needs are met) to Canada and the southwestern U.S. Headquarters are in Portland, Oregon; there are two control centers (eastern and western Washington). BPA has functionally separated its power and transmission responsibilities in accordance with FERC Orders 888 and 889. The seven Regions operate and maintain the transmission system, but take their direction from Headquarters.

- **Terrain/Population/Development**

  - **WAPA:** Most of WAPA's service area is rural. The terrain ranges from the agricultural plains states, across the Rocky Mountains, to the arid southwest, and the agricultural lands and mountains of northern California. Other than Phoenix and Las Vegas, few large city pairs are conveniently located along WAPA transmission corridors that would provide an obvious telecommunications path. Consequently, there has been a limited demand from TSPs to use WAPA's transmission corridors. WAPA is starting to receive more requests to participate in telecom projects as the demand for telecom services expands and rural areas and smaller population centers begin to be developed.
  - **SWPA:** SWPA's service area is made up of agriculture, rolling hills, timbered, and National Forest land. Population is growing rapidly in some areas; in

general, however, SWPA's transmission facilities bypass most major metropolitan areas. The two largest cities connected to SWPA's transmission system are Jonesboro, Arkansas (population 51,000), and Springfield, Missouri (population 150,000.) Some discussions have taken place with TSPs, but no arrangements have been made for joint installation or lease.

- **BPA:** The Pacific Northwest offers great diversity in terrain, from mountain ranges to desert, coastal estuaries to broad agricultural valleys. It includes large population centers (Seattle, Portland) that punctuate a long valley interspersed with mid-sized to smaller towns, as well as scattered large population centers in eastern Washington (Spokane), Idaho (Boise), and Montana (Missoula). Population is continuing to grow, with concomitant demand for communications services for industry (especially computer-related industries), schools, hospitals, and residential needs. Larger city centers are absorbing smaller satellite communities on the outskirts. Telecommuting is being encouraged as an alternative for reducing traffic gridlock in the larger cities. Medical and educational services, as well as economic development opportunities, via communications networks are in increasing demand in desert/rural communities. TSPs have moved and are moving aggressively into the Pacific Northwest to meet the developing needs where such buildout is commercially attractive.

- **Finances and Funding Authority**.
  - **WAPA/SWPA:** Both WAPA and SWPA are funded by annual federal appropriations; revenues received from the sale of power and other services are deposited in the Treasury.
  - **BPA:** BPA has self-financing authority. It receives no annual appropriations from Congress. It funds its costs through revenues received from selling power, transmission, and related services, and from the sale of bonds to the U.S. Treasury. BPA repays these bonds with interest.

PART III: DIFFERENCES IN FIBER-OPTICS APPROACHES

- **Scope of Program.** The three PMAs are very different in the number of fiber-optic miles they have built, and the number of miles they anticipate building.
  - **WAPA:** WAPA has built 19 projects consisting of a total of 493 miles as of March 2000; of these, 15 are less than 25 miles in length. These relatively short installations are between substations, power plants, microwave sites, and customer utility sites. Future projects (the remainder of FY00 through FY05) will account for an additional 619 miles, with the majority of the projects being less than 30 miles in length.
  - **SWPA:** To date, SWPA has built 10 projects; these connect SWPA substations and/or Corps dams. SWPA places a priority on completing loops in its eastern and central regions; then around western and southern portions of the transmission system. From FY88 through FY99, it installed 483 miles of

fiber-optic cable and three microwave radio systems. It estimates that 225 miles of fiber-optic cable will be installed in FY00; a total of 740 miles of fiber-optic cable is to be installed in FYs 01 - 05.

- **BPA:** As of December 1999, BPA has built nine projects for 1,975 miles of fiber-optic cable. Project lengths range from 46 to 558 miles. BPA places a priority on completing loops linking major substations on its transmission backbone (larger loops of 600 to 1000 miles), with future emphasis on developing smaller loops of 100 to 200 miles to increase reliability through redundancy. Completion of loops is anticipated throughout its system, and includes some major urban centers on routes where there is a high demand for fiber-optics and many rural areas that are currently "fiber-optic deficient." Projects for FY00 include 621 miles of fiber-optic cable installation; projects for the future (FYs 01 - 05) include about 1,760 miles of additional fiber-optic cable installation.

Operational Needs/Anticipating Future Need

- **WAPA:** For WAPA, fiber-optic cable systems provide a state-of-the-art option to support its communication system. Within the last 15 years, WAPA has used fiber-optic cable both as an enhancement and as a replacement for existing communication systems. Fiber-optic cable offers many benefits over older technologies. These benefits fall into three basic categories: improved communication capacity, improved reliability, and cost effectiveness. WAPA does not try to project future growth and demand outside its operational requirements. WAPA typically installs cables of between 12 and 48 fibers, which "reflects a reasonable number for Western's, other utility, or Reclamation uses, and future expansion."
- **SWPA:** SWPA aims to complete replacement of its current communications system by 2005. It currently requires six fibers for its operational communications system. SWPA does not forecast its future need to exceed 12 fibers, but states that "This requirement may change as new facilities are constructed by other utilities that interconnect with Southwestern's electric transmission system."
- **BPA:** Because BPA oversees transmission for both growing regional loads and a robust wholesale marketplace; it anticipates a corresponding growth in the demands placed on the agency for accurate, instantaneous ability to control, re-route, and track power in the near and distant future. It has documented a significant rise in internal demand for communications capacity over the past 2 years. Extrapolating from current use and development of a Regional Transmission Organization (RTO) (which will most likely require power utilities to interconnect with BPA's existing system to schedule, buy, and sell power throughout the PNW and beyond), BPA has prepared three snapshots of likely fiber-optic needs from 2008 to 2025. By 2008, it anticipates that 16 fibers will be needed (12 for operational purposes, 4 for

RTO); by 2018, 64 fibers; and, by 2025, 76 fibers.[3] This number is based not on maximizing capacity (how much data can be carried over a single fiber—the TSP approach) but on supporting reliability—keeping the lights on without fail. The latter approach requires both spares and redundancy, while dedicating separate pairs of fibers to various monitoring and controlling tasks to ensure that "all eggs are not in one basket."

- **Fiber-optic Cable Size**

  - **Note:** Choice of cable size is directly related to definition of need (see above). WAPA and SWPA are replacing their *existing* communication systems with more efficient fiber-optic cable; BPA is incorporating future need projections (for FYs 08, 18, and 25) that anticipate potential higher fiber requirements, based in part on the need for reliability and redundancy. Although each PMA installs cable of different sizes, all three PMAs note that it is more cost-efficient to install a higher-count cable now than to uninstall and re-install sooner than the life span of the cable.

  - **WAPA:** WAPA has installed cable as small as eight fibers. However, current projects call for installing 12- to 48-fiber cable, with the majority at 24 fibers.

  - **SWPA:** Most installations are of 12-fiber cable to meet current needs. As noted earlier, this number may rise.

  - **BPA:** BPA initially installed 36-fiber cable. However, growing demand and projected future need has revised that decision. Given the anticipated 40-year cable life and future operational needs, BPA now installs 72-fiber cable as a standard on its transmission backbone.

- **Financing/Third-party Arrangements/Marketing of Excess Fiber**

  - As noted in Part I, all three PMAs have sought to reduce the cost of upgrading their respective communications systems through cost-share or facility-trade arrangements with third parties and/or through leasing of temporarily excess dark fibers. However, those arrangements differ.

  - **WAPA:** WAPA has arranged for ways to share the costs of installing fiber-optics. WAPA sees the chief benefit of these arrangements as the receipt of upgraded communications at reduced cost. Examples of cost-share include the 270-mile Phoenix-Marketplace project, where the third party paid for most of the cable and installed it; Reclamation and WAPA use a combination of eight fibers on this system. Future projects, though mostly smaller, will also occur under joint support from Reclamation or local utilities.

    WAPA does not actively market excess fiber to third parties. Their fiber is typically located on short, rural routes not much in demand by others. However, the Phoenix-Marketplace project, in addition to providing WAPA with

[3] Snapshots and additional information are found in Appendix C to BPA's Congressional Report. Note that, because they had insufficient communications, the California ISO has had to lease fibers from MCI at a cost of $180M in order to meet their communication needs for five years (*Utility Automation*, Sept./Oct. 1998).

a 270-mile fiber-optic path, also nets WAPA a fee for use of the transmission line and for maintenance. WAPA has also installed a 48-fiber cable jointly with two electric power cooperatives; the cooperatives lease out their fibers and pay WAPA 10 percent of the revenues.

- **SWPA:** SWPA has also made arrangements to reduce costs by "swapping" fiber-optic access with others. In exchange for a rural coop's access to 40 miles of six dark fibers on one route, SWPA has received access to six dark fibers over the coop's transmission system, eliminating the need to install its own fiber-optic system. A second agreement is under discussion. Similar facility trades are in place with the Corps.

  SWPA has published notices inviting interested parties to discuss possible leasing of temporarily excess dark fibers. However, there has not yet been much response.

- **BPA:** BPA has cost-shared with several telecommunications providers to reduce cost to BPA and Northwest ratepayers. Leasing arrangements have included revenue-sharing, projects funded in advance (PFIA), asset contribution (e.g., terminal equipment), and lump sum payment or leases on an annual basis. Contracts have been structured to achieve payback within 5 years. After payback has been accomplished, any additional revenues are used to moderate rate increases. The agency has also worked with rural communities, economic development councils, and public utility districts to bring "public benefit" fiber-optics within reach of rural and underserved areas (see "Public Benefits," below). These arrangements are also structured to achieve payback for fiber use, but at a slower and more affordable pace for communities on the other side of the "digital divide."

  Agreements for leasing temporarily excess dark fibers are made for anywhere from 5 - 20 years. For the near-term future, BPA retains at least 12 fibers for operational use and 4 additional fibers for the expected NW RTO. As contracts reach termination, additional fibers can be retrieved to meet growing operational need.

Cost per Mile/Expected Revenues

- All three PMAs provide data on cost per mile for fiber. However, cost accounting methods are somewhat different. *The figures provided are therefore not directly comparable.*

- **WAPA:** WAPA's costs reflect loaded labor and material cost for dark fiber installation. They *do not* include the following: (1) terminal equipment; (2) costs to (contributions by) participating entities. Under this method, WAPA's cost per mile for projects to date is $10,409; anticipated future per-mile costs are $18,638. This *future cost* figure may decrease, depending on participation by other entities in the projects.

  Expected revenues are $85,000 annually from the Phoenix-Marketplace arrangement; approximately $12,500 annually (possibly higher) from the electric cooperative arrangement.

- **SWPA:** SWPA's costs to date include *direct* cost of all labor, travel, rent, contracts, supplies, and equipment (including fiber-optic terminals): this works out to $39,883 per mile. These costs include some expenditure for reinforcement of structures and other maintenance required during replacement of the overhead groundwire. SWPA anticipates a lower cost per mile ($23,378) in its upcoming projects (FYs 00 - 05), due to the two partnering arrangements and reduced installation contract costs.

  No revenues from fiber-optic leases are projected at this time.

- **BPA:** BPA's capital expenditures to date are reported as *loaded* costs, and include projects covered through PFIA or one-time lump sum by participating entities. The typical loaded cost for a project to date is $50,000 per mile (covering design, installation, materials, and overheads); calculated as *direct* costs for materials, design, and installation, this figure would be $38,400. Future projects will be covered under lump-sum arrangements or paid back on a 5-year basis (except for Public Benefit fibers; see below). Annual fees are still an option to recover some (but not all) of the initial capital expenditure.

  Projected cash and asset receipts from fiber-optics projects for FY97 through FY00 are about $43M.

Public Benefit Fiber-optics Program

- **WAPA/SWPA:** WAPA and SWPA are providing a benefit to the public by providing faster, more accurate, and more reliable communications to operate their power systems. By installing fiber-optics, they also add to the value of the transmission network.

- **BPA:** In addition to providing those benefits noted under WAPA/SWPA, BPA has committed to reserving, from its currently excess fibers, at least four fibers to be available for public interconnection/benefit. The program is aimed at rural communities, public entities (e.g. hospitals, schools, libraries), other federal agencies, and customers. The goal is to expand access to advanced telecommunications services to underserved rural communities and to make this access to services more affordable. This would mean providing additional capacity to underserved areas and possibly first capacity to areas without service. BPA has one agreement in place for such benefits—with Northwest Open Access Network in Washington. A second agreement in Oregon is under development.

COMPARISON OF SOME KEY FACTORS

	WAPA	SWPA	BPA
Miles installed to date	**493**	**483**	**1,975**
Number of fibers anticipated for future need	**12 - 48**	**12 (may change as new facilities are built)**	**12 by 2008** **64 by 2018** **76 by 2025**
Average cost per mile	**$10,409 / $29,386[1]**	**$39,883[2]**	**$50,000 / $38,400[3]**
Miles of transmission-line right-of-way	**17,000**	**1,380**	**15,000**
FY99 revenues on leases	**$97,500**	**0**	**$3.7M**
Cable size (currently being installed)	**12 - 48 fibers**	**12 fibers**	**36 - 72 fibers[4]**
Expected FY00 revenues	**$97,500**	**0**	**$10.5M**

[1] **Costs are loaded. Costs do not include terminal equipment. The first cost does not include costs borne by others under cost-share agreements. The second cost reflects WAPA costs on *only* those projects where no cost-sharing occurred.**

[2] **Costs are direct. Costs include all SWPA labor, travel, rent, contracts, supplies, and equipment (including fiber-optic terminals).**

[3] **First cost is loaded; second is direct (unloaded). Costs include all labor, equipment, and costs borne by others under cost-share agreements.**

[4] **72-fiber cable is being installed for BPA backbone applications.**

APPENDICES

Appendix A: Fiber Optic Cable Plan: Western Area Power Administration (March 17, 2000)

Appendix B: Fiber Optic Cable Plan: Southwestern Power Administration (February 11, 2000)

Appendix C: Bonneville Power Administration Fiber-optic Cable Plan (March 27, 2000)

Appendix A

Fiber Optic Cable Plan:
Western Area Power Administration

Appendix B

Fiber Optic Cable Plan:
Southwestern Power Administration

Appendix C

Bonneville Power Administration
Fiber-optic Cable Plan